

**Amendments to the Drawings:**

Drawing numerals have been renumbered and missing numerals have been added to overcome the Examiner's objection. No new matter has been introduced. Replacement drawings for Figures 4-5 are attached to this reply. Applicant requests the substitution of the new drawings for the drawings currently on file in the application.

Attachment: Two Replacement Sheets

**REMARKS/ARGUMENTS**

With this amendment, claims 1-13 will be pending in the present application. Claims 5-13 have been withdrawn. Claims 1-4 have been amended. Claims 1-2 amendments find support throughout the specification, in particular on page 10, lines 6-12; page 12, lines 5-8; and page 17, lines 3-12 of the specification as filed.

The claims have been reworded to substitute the routinely used “wherein” for the less common “characterized in that.”

**Specification Objection**

The disclosure have been objected to because of the allegedly unclear units in the phrase “6.7 bara” in paragraph [0049]. Applicants have replaced the unit shorthand “bara” with its full name: “bar absolute.” Applicants submit that the above objection has been overcome.

**Claims Objections**

Claim 3 has been objected to because it erroneously recites: “steam (361) is injected.” The Examiner correctly suggested that the wording “steam (359) is injected” would have been proper.

Applicants thank the Examiner for pointing to this error. However, the error in fact originated in the drawings, not in the text of the specification. Therefore, applicants submit replacement figures 4 and 5, which now correctly show added numeral 359. Furthermore, applicants have replaced numeral 359 in the pre-amended figures 4 and 5 with numeral 358 in the replacement figures 4 and 5. No new matter has been added.

Applicants submit that the above claim objections have been overcome.

**Claims Rejections – 35 § U.S.C. 112, second paragraph**

Claims 1-4 have been rejected under 35 § U.S.C. § 112, second paragraph as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, claim 1 limitation “the main part

of the H<sub>2</sub> and CO” and claim 2 (the Office Action erroneously cites claim 4) limitation “most of the CO<sub>2</sub>” are allegedly unclear.

Applicants have amended claim 1 by replacing the limitation “the main part” with “the majority.” Claim amendment finds support throughout the specification, in particular on page 17, lines 3-12 of the specification as filed. The allegedly unclear limitation of claim 2 has been deleted.

Applicants submit that the above claim rejections have been overcome.

### **Claims Rejections – 35 U.S.C. § 103(a)**

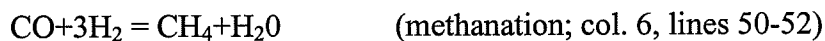
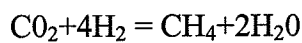
#### **Claim 1**

Claim 1 has been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Schramm (U.S. Patent No. 5,079,103) in view of Edlund (U.S. Patent No. 5,997,594). The Office Action states that Schramm discloses a method for gas treatment, but does not teach that the separation process is based on H<sub>2</sub> selective membranes. The deficiency of Schramm is allegedly overcome by Edlund, which allegedly discloses an internal hydrogen purification using the hydrogen-permeable and hydrogen-selective membranes to remove trace levels of CO and CO<sub>2</sub>. The Office Action goes on to state that the process for producing purified hydrogen in Edlund begins by reacting an alcohol (methanol CH<sub>3</sub>OH – comment by the undersigned) or a hydrocarbon (methane CH<sub>4</sub> – comment by the undersigned) and steam to produce product hydrogen, carbon monoxide, and carbon dioxide (col. 2, lines 18-40 of Edlund).

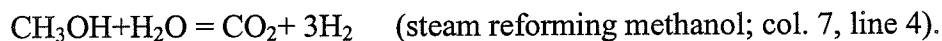
Applicants have amended claim 1 as set forth above. Amended claim 1 is not obvious over Schramm in view of Edlund at least because the hypothetical combination of Schramm and Edlund does not disclose or in any form suggest the following limitation of amended claim 1: “the membrane or an included catalyst has water-gas-shift activity and catalyses the water-gas-shift reaction” (emphasis added).

Edlund, which is relied upon for the alleged disclosure of a separation process based on H<sub>2</sub> selective membranes discloses processes (i) “whereby carbon monoxide and carbon dioxide in the methanation catalyst bed convert to methane and yield a product hydrogen stream

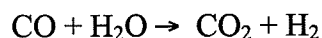
with concentrations of carbon monoxide and carbon dioxide below said given level.” (col. 2, lines 30-34) and (ii) “Optionally, reforming catalyst may also lie at the permeate side of the membrane along with the methanation catalyst to convert to product hydrogen any unreacted alcohol or hydrocarbon feed that passes through holes or other defects in the membrane.” (col. 2, lines 34-39). Further details about the above processes are given in col. 6, lines 50-52 and col. 7, line 4, where chemical formulae for the methanation and the steam reforming methanol processes, respectively, are disclosed as:



and



In contrast to Edlund, amended claim 1 requires water-gas-shift activity and water-gas-shift reaction (emphasis added). A person skilled in the art would have at his or her disposal the “Encyclopedia of Chemical Processing,” by Sunggyu Lee and Lee Lee, 2005 (CRC Press, 2005, ISBN 0824755634, 9780824755638), which on page 3205 defines water-gas-shift reaction as:



The above water-gas-shift reaction is not disclosed or suggested by Edlund, which relies on the methanation and steam reforming methanol reactions for its hydrogen production. Furthermore, the person of ordinary skill in the art would have no reason to otherwise radically modify Edlund or, for that matter, Schramm, way beyond what is thought by these references in order to come up with the membrane or an included catalyst that has water-gas-shift activity and catalyses the water-gas-shift reaction, as required by claim 1, unless he or she were to follow the teachings of the present invention, which would amount to an impermissible hindsight reconstruction, which cannot form the basis for rejecting the claims as obvious.

Therefore, claim 1 is not obvious over Schramm in view of Edlund, because the references fail to teach or suggest the above limitation of amended claim 1.

### **Claim 2**

Claim 2 has been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Schramm in view of Edlund and further in view of Hsu (U.S. Patent Application 2003/0008183). The Office Action states that although Schramm in view of Edlund fails to disclose the anode exhaust is treated such that most of the CO<sub>2</sub> is not emitted to the atmosphere, the missing disclosure is allegedly provided by Hsu.

As explained in detail above, claim 1 is not obvious over Schramm in view of Edlund. The additional reference Hsu does not provide what is missing from the primary and secondary references. Thus, claim 1 is not obvious over Schramm in view of Edlund and further in view of Hsu. Claim 2 is allowable at least because it depends from allowable base claim 1. Claim 2 is further allowable because it is directed to independently patentable subject matter.

### **Claim 3**

Claim 3 has been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Schramm in view of Edlund and further in view of Hamada (Japanese Patent JP 11-116202 A). The Office Action states that although Schramm in view of Edlund fails to disclose that steam is injected on the permeate side of the hydrogen selective membranes, the missing teaching is allegedly provided by Hamada, which teaches the use of a sweep gas to discharge the permeate side of a hydrogen separation membrane.

As explained in detail above, claim 1 is not obvious over Schramm in view of Edlund. The additional reference Hamada does not provide what is missing from the primary and secondary references. Thus, claim 1 is not obvious over Schramm in view of Edlund and further in view of Hamada. Claim 3 is allowable at least because it depends from allowable base claim 1. Claim 3 is further allowable because it is directed to independently patentable subject matter.

**Claim 4**

Claim 4 has been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Schramm in view of Edlund, as explained in detail above.


Claim 1 is not obvious over Schramm in view of Edlund. Claim 4 is allowable at least because it depends from allowable base claim 1. Claim 4 is further allowable because it is directed to independently patentable subject matter.

**CONCLUSION**

In view of the foregoing, applicants submit that this application is in condition for allowance, and a formal notification to that effect at an early date is requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (415) 273-4317 (direct dial).

Respectfully submitted,



Dr. Jadran (Adrian) Mihailovic  
Reg. No. 57,874

TOWNSEND and TOWNSEND and CREW LLP  
Two Embarcadero Center, 8<sup>th</sup> Floor  
San Francisco, California 94111-3834  
Tel: (415) 576-0200  
Fax: (415) 576-0300  
JGS:jhw  
61843166 v1